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April 15, 1997

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Federal Communications Commission
Office of Secretary

Mr. William F. Caton
Acting Secretary
Federal Communications Commission
1919 M Street, N.W. Room 222
Washington, D.C. 20554

RE: In the Matter of Federal-State Joint Board on Universal Service - CC Docket No. 96-45

Dear Mr. Caton,

Today, representatives of Sprint and U S WEST met with Kathleen Levitz and Timothy Peterson of the Commission's Common Carrier Bureau to discuss the use of proxy cost models in the above referenced proceeding. Representing Sprint were Mark Askins, Brian Staihr, and the undersigned. Representing U S WEST was Glenn Brown. Also, in attendance was Jim Stegeman of INDETEC International.

The attached information was used in the meeting. Sprint and U S WEST request that this information be made a part of the record in this matter. Two copies of this letter, in accordance with Section 1.1206(a)(1), is provided for this purpose. If there are questions with regard to this notice, please feel free to call.

Sincerely,

Warren D. Hannah

Warren D. Hannah

Attachments

c: Attendees

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Preliminary Review
of the
Hatfield 3.1 Model

presented by US West and Sprint
with INDETEC International
April 7, 1997

OVERVIEW

- The source of the ***CBG data*** has been changed and the results are often inexplicably different than in the most recent iteration of the model

- Although numerous ***inputs*** can be adjusted by the user, several of those that are changed by the user are ignored - - they are not utilized in the calculations that cost out the network. Also, numerous critical inputs are hard-coded.

- There are ***faulty assumptions*** in the algorithms.

- There are many, many ***logic errors***.

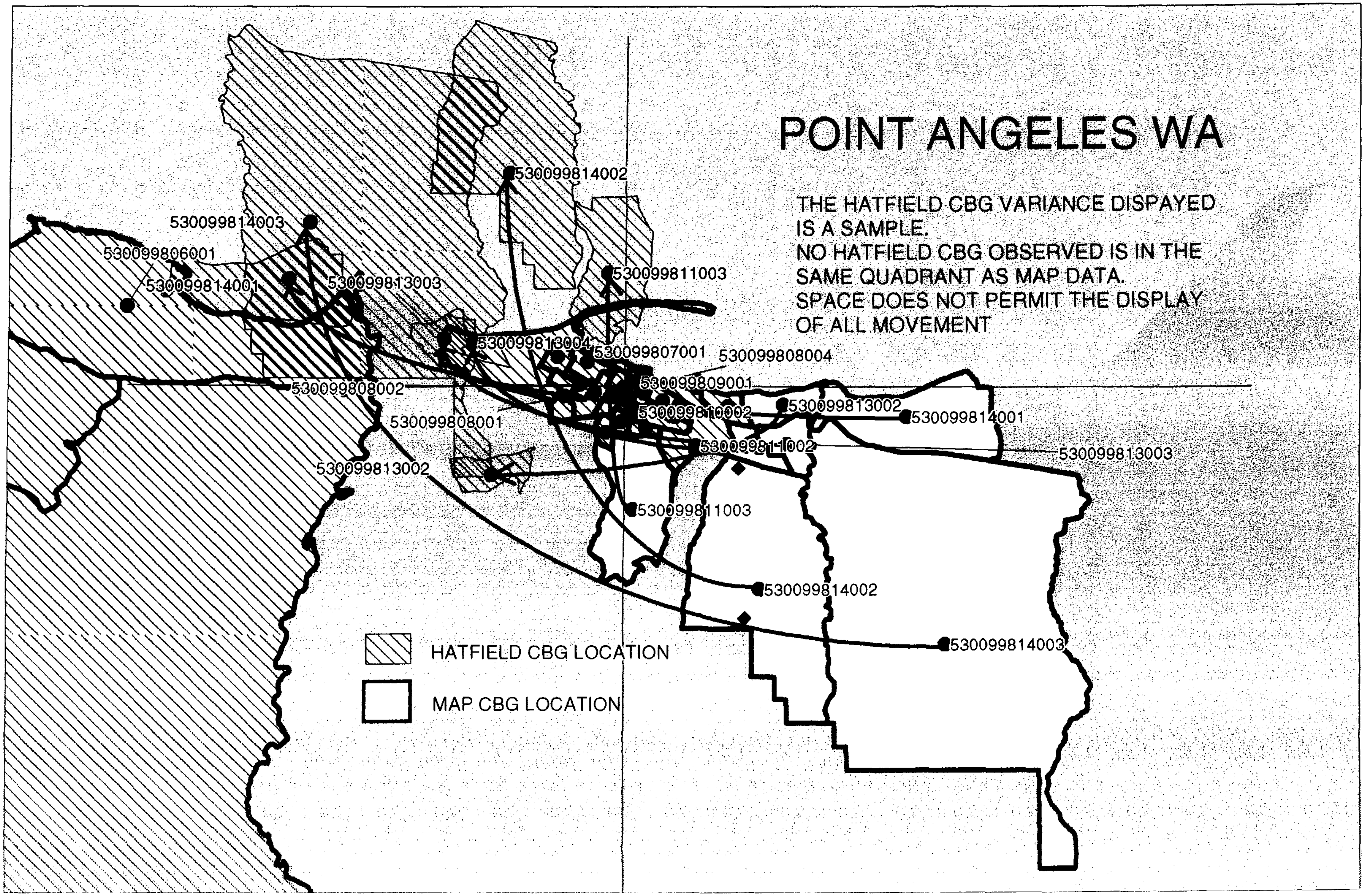
- There are numerous plant ***omissions*** from the network. The network that is costed out by the Hatfield 3.1 model will not work.

CBG DATA

The 3.1 version of the model uses clustering data provided by PNR to locate the households and businesses. This new source of data seems to have created a series of inexplicable results. Many of the CBG centroids have changed their location in relationship to the central office. Where the direction to the central office was once east, for example, the direction is now west. The change in the directional orientation varies from just a few degrees in some cases to over 180 degrees in others.

It is understandable that a change in the source of locational data would create minor changes - - in either distance, orientation, or both. However, the changes are so dramatic and seemingly un-patterned as to raise doubts as to their veracity.

Distance from the office has also changed drastically - - but again only in some cases. The combination of orientation and distance changes has placed some centroids in the middle of water. In looking at just a few CBGs served by General Telephone in the state of Washington we have found numerous inexplicable changes. A map has been included to highlight the types of inexplicable changes that have occurred.



POINT ANGELES WA
THE HATFIELD CBG VARIANCE DISPAYED IS A SAMPLE.
NO HATFIELD CBG OBSERVED IS IN THE SAME QUADRANT AS MAP DATA.
SPACE DOES NOT PERMIT THE DISPLAY OF ALL MOVEMENT
530099814002
530099814003
530099806001
530099814001
530099813003
530099811003
530099813004
530099807001
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HATFIELD CBG LOCATION
MAP CBG LOCATION

USER INPUTS NOT ALWAYS USED

The documentation rightly states that many inputs can be modified by the user. It was disconcerting, however, to discover that not all of those inputs that are made by the user flow through to the actual calculation of the costs of the network. That is, the user can make a change to the default values in the user input interface, but that change is not used when it comes time to do the calculation.

Examples were found in the expense inputs, the feeder inputs, and the distribution inputs. Some user modifications in the structure fraction assignment in the expense area is not recognized. Any user modification to the regional labor multiplier is not recognized. Any change to the town lot size is not recognized.

An interesting treatment of town lot size warrants further discussion. When a change is made by the user to the *town* lot size, the model immediately modifies the *maximum* lot size to equal the value that was input for the town lot size. The *maximum* lot size is then used in the calculation and the change in the *town* lot size is ignored and the value reverts back to the default value of three acres.

CRITICAL INPUT DATA IS HARD CODED

The documentation rightly states that numerous input values can be modified by the end user. Unfortunately, the 3.1 model continues to hard code critical variables.

- Fiber is only installed if lines per quadrant exceed 24.
- The cable gauge multiplier is only permitted to affect 16% of the cable costs.
- The regional labor adjustment is only permitted to affect 12.5% of the buried and conduit placement costs.
- The high rise indicator fixes the area trigger (expressed in square miles) at .03 square miles and fixes density (expressed in lines per square mile) at >30,000 (column BE).
- The high -rise factor fixes occupied building space at 1500 square feet per household and 200 square feet per employee (column BF).
- The number of riser pairs required per cable is fixed at twice the number of households plus half the public, special, and business lines (column BG).
- The number of maximum riser cables divisor is fixed at two (column BH).

FAULTY ASSUMPTIONS

Although the review team has only been able to scrutinize half of the distribution module, and has not yet analyzed the other modules, there are numerous concerns with the algorithms in that module. There are faulty assumptions, logic errors of various kinds, and numerous omissions of outside plant necessary for a working network.

One example of a faulty assumption is the capping of the average lot size at three acres. We find that assumption to be unreasonable. While it may be understandable in an attempt to reduce the cost of the network, the assumption makes a mockery of reality.

Taking a random sample of Sprint-served CBGs revealed the following:

- Missouri average lot size = 13.7 acres
- Kansas average lot size = 17.4 acres
- Nebraska average lot size = 29.5 acres

From the perspective of dollars, the impact of such an assumption is not insignificant. Looking just at the Sprint territories in Missouri, if the average lot size were allowed to increase by one acre (up to four acres), the same Hatfield 3.1 model calculations would produce an additional $7.8 million. Allowing the average lot size to increase by four acres (up to seven acres) would yield an additional $18.9 million over the original calculation.

The impact of this assumption, coupled with the Hatfield 3.1 clustering mechanism produce misleading results. The Hatfield Model 3.1 uses the term "clustering' to describe its approach to building the network in less dense areas (CBGs with density < 200 lines per square mile.) Customer locations (both business and residential) are grouped together to produce a smaller geographic area served by the LEC. However, two serious problems exist with the method used by the model:

- *There is no evidence that engineering or geographically-based criteria are used as a basis for this grouping.*
- *Clusters of locations that actually exist are ignored by the grouping algorithm.*

As a result, the model produces serious distortions of customer location and the cost of serving them.

To illustrate this problem, the diagram below contains 4 stylized CBGs: A, B, C and D. Each oval represents 10 households for a total of 100 households per CBG.

Each stylized CBG has the same land area, same number of census blocks (8, defined by the dotted line), same amount of unpopulated area (25%). However, in certain CBGs the customers are clearly situated in groupings or "clusters". The

CBG labeled "A" shows 5 clusters. "C" shows 2 clusters. "D" shows 4 clusters and "B" does not show any obvious clusters.

- *The grouping algorithm in the Hatfield Model 3.1 would ignore the existing clusters, and build the same number of clusters, four (4), in every CBG. Eighty-five percent of customers would be placed within these 4 clusters (85% is the Hatfield default value).*

  The only criteria for determining the number of clusters used in the Hatfield model is the amount of unpopulated area, which is the same in CBGs A, B, C and D.

- *More importantly, the size of the four clusters would be exactly the same for each of the four CBGs, ignoring the actual amount of area in which customers are located.*

  Each household in a cluster is given a lot size of 3 acres, the lots are assumed adjacent, and this forms the area of the cluster.

- *In addition, the **number of customers** in each cluster would be exactly the same for each of the four CBGs.*

  Each Hatfield cluster is constructed to contain 1/4th of 85% of customers. In doing this, existing clusters (such as those found in CBG "C") are ignored by the model.

- ***Example of Size Distortion:** A CBG located in Chilhowee, Missouri has an overall area of 78.5 square miles, and a populated area of 76.9 square miles. The Hatfield 3.1 model places 85% of residents within an area of two (2) square miles.*

  As a result of this grouping process, the amount of distribution cable needed to serve customers is grossly distorted, as is the amount of investment required. Shown below as an example are two CBGs taken from Sprint territory in Missouri.

The two are significantly different in terms of size, population and density. Yet as a result of the Hatfield 3.1 "clustering" process, the model produces nearly identical results for the two.

One CBG is located in **Deepwater, Missouri** (south of Clinton, Missouri). The other is in **Newberg** (right outside Rolla, Missouri).

The Deepwater CBG (290839504005) serves approximately **330** customers in a populated area of **60 square miles**.

The Newberg CBG (291619905003) serves approximately **490** customers in a populated area of **35 square miles.**

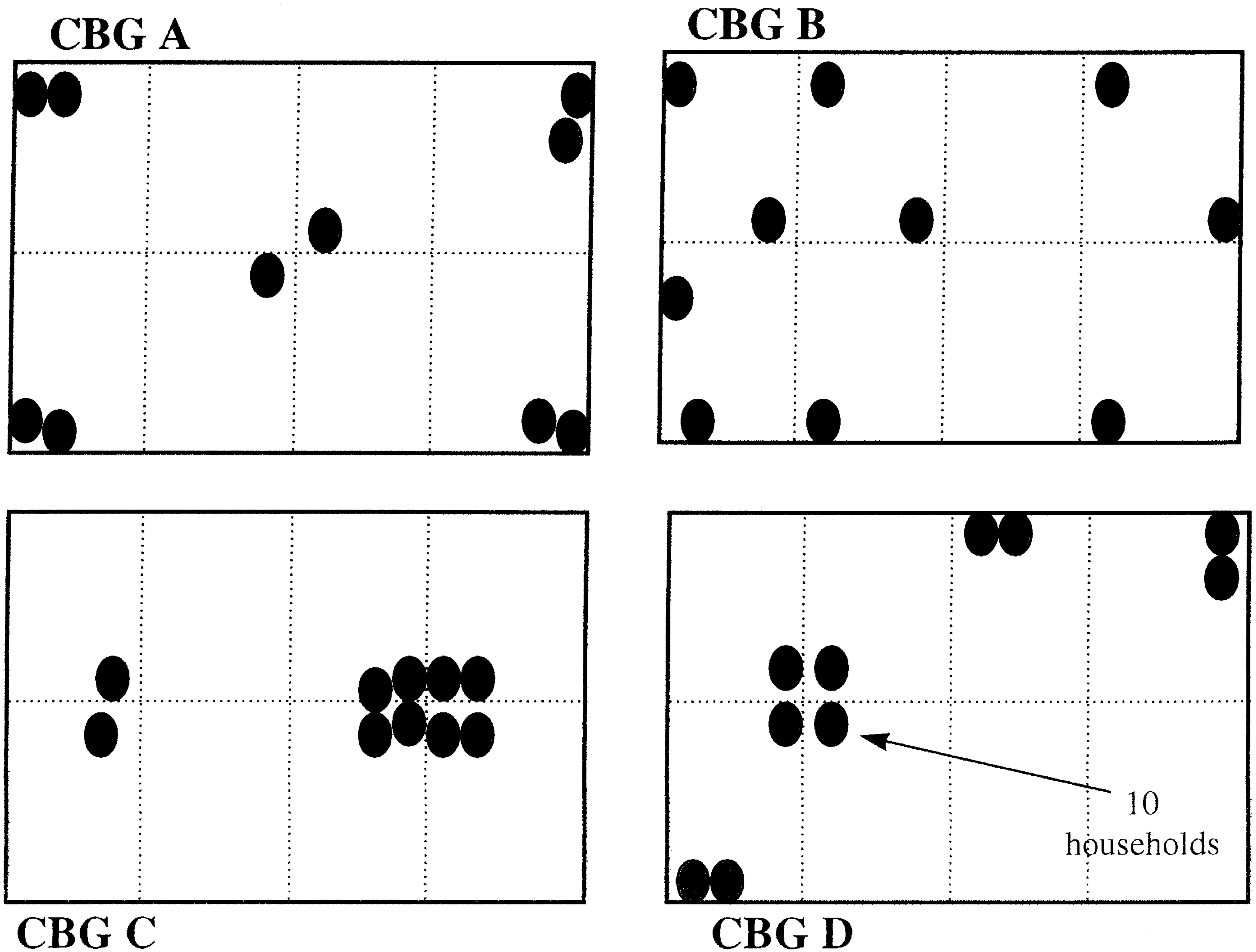
Hatfield 3.1 Model Results (Distribution Module)

	Total Distribution Distance	Buried Distribution Cable $	Aerial Distribution Cable $
Deepwater	312,269	$365,529	$117,157
Newberg	311,907	$359,766	$115,310

As the table shows, the Hatfield 3.1 model produces equal amounts of distribution and investment, despite the fact that the CBGs differ in area by nearly 25 square miles.

This overall distortion is exacerbated by the fact that all CBGs with a density under 200 lines per square mile are "clustered" (assuming the area of the cluster is smaller than the populated area.) There are 39,739 CBGs that fall into this density category, approximately 18% of all CBGs.

The BCPM, in contrast, takes into account existing customer location (both orientation and distance) when calculating area in less dense regions by using the underlying road network.



CBG A
CBG B
CBG C
CBG D
10
households

LOGIC ERRORS

In building the lot sizes, the Hatfield model assumes that every lot is twice as deep as it is wide. Without comment on the accuracy of that assumption, let it be said that the calculation to reflect that assumption is flawed. The calculation methodology is to take the square root of the area, and multiply that by ½ to determine the lot frontage. They then multiply the original side by 2 to calculate the depth. Unfortunately that yields a depth to frontage ratio of 4:1, not 2:1.

The proper multiplier for the frontage should be .7070, not ½.

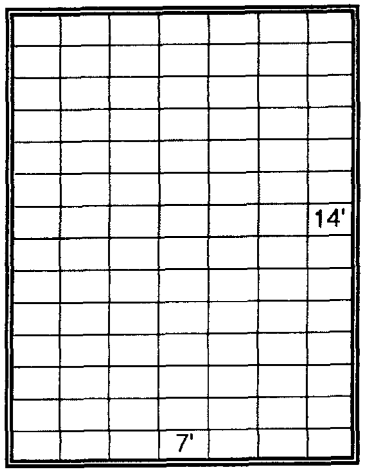
Placing illustrative numbers into the description may help describe the errant situation. If the lot were 40,000 square feet, the Hatfield model would take the square root of that to determine its side as 200 feet. It would then (incorrectly) multiply that by .5 to calculate the frontage (incorrectly) at 100 feet. It would then go back to the original side of 200 feet and multiply that by 2 to come up with a side of 400 feet. That results in a side of 400 feet and a front of 100 feet - - a 4:1 ratio of depth to frontage - - with resultant construction changes as well.

The impact of this logic error is rather widespread as the output of the calculation ripples throughout other portions of the distribution module. It has an effect on the following:

- backbone cable length
- branch cable length
- number of branch cables
- vertical connecting cable
- need for remote terminals
- pairs required per branch

The following diagram highlight visually the impact of this logic error.

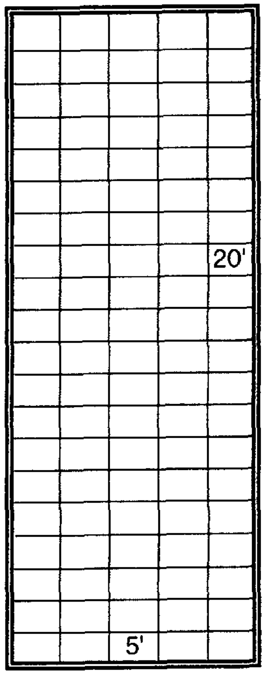
HATFIELD 3.1
LOT SIZING FOR 100 SQUARE FOOT LOT



What Hatfield 3.1 says it does.

.5 * Square Root of 100
= 5 on Front

That means
20' deep.



What Hatfield 3.1 actually does.

Correct formula should be: .707 * Square Root of Area

This miscalculation flows through to distribution area and investment results.

MORE LOGIC ERRORS

The calculation for difficult terrain also has a significant problem. Interestingly enough the default value for difficult terrain is one. That is, in the Hatfield model, where the increased cost for placing plant in difficult terrain is recognized by a multiplier of the length, the default value is one. Therefore, unless the user changes the default value, no recognition of difficult terrain would be made at all.

That issue notwithstanding, if the user does indeed change the multiplier, it should then be multiplied by the distance of the terrain that has the difficult soil. However, in the 3.1 version of the Hatfield model, the multiplier is applied to the simple terrain, not the difficult terrain. That is if a five mile route had two miles of rocky soil, the difficult terrain multiplier put in by the user would be incorrectly multiplied by *three* miles (the easy terrain) instead of the two mile section of difficult terrain. (This can be seen in the calculation worksheet, column L.)

LOGIC ERRORS (continued)

The calculation for digital terminals is incorrect. In the calculation worksheet, columns AZ, one can see that the quantity of terminals for high density areas (column AY) is incorrectly used in low density area investment. A low density quantity (column AX) is calculated, but is not used in the investment calculation.

This error would have the effect of understating the cost of the network. For the Sprint territory in Missouri alone, this represents a movement from $1.5 million to $2.1 million, a 36% difference.

OMISSIONS

During the investigation of the distribution module, it became evident that several critical portions of the network have been left out. This has two obvious results: the cost of the network required by law is understated and the network won't work.

Pole investment is missing in dense areas. Looking at the calculation worksheet, column AM, one can see that if the density in an area is greater than 5000 households per square mile, no pole investment is included. This is puzzling since the distribution plant is purported to be 65% aerial for areas of density greater than 5000 households per square mile, and 85% aerial for areas of density greater than 10,000 households per square mile.

For Bell Atlantic territory in Delaware , for example, to properly include the poles increases the investment from 18.0 million to $20.5 million (a 14% increase).

Manhole investment is totally missing. A review of the calculation worksheet, column AO reveals that absolutely no investment for manholes is included.

All of the ***horizontal connecting cables*** are left out as well, except where low density remote terminals are used. Column AI on the calculation worksheet shows that omission.

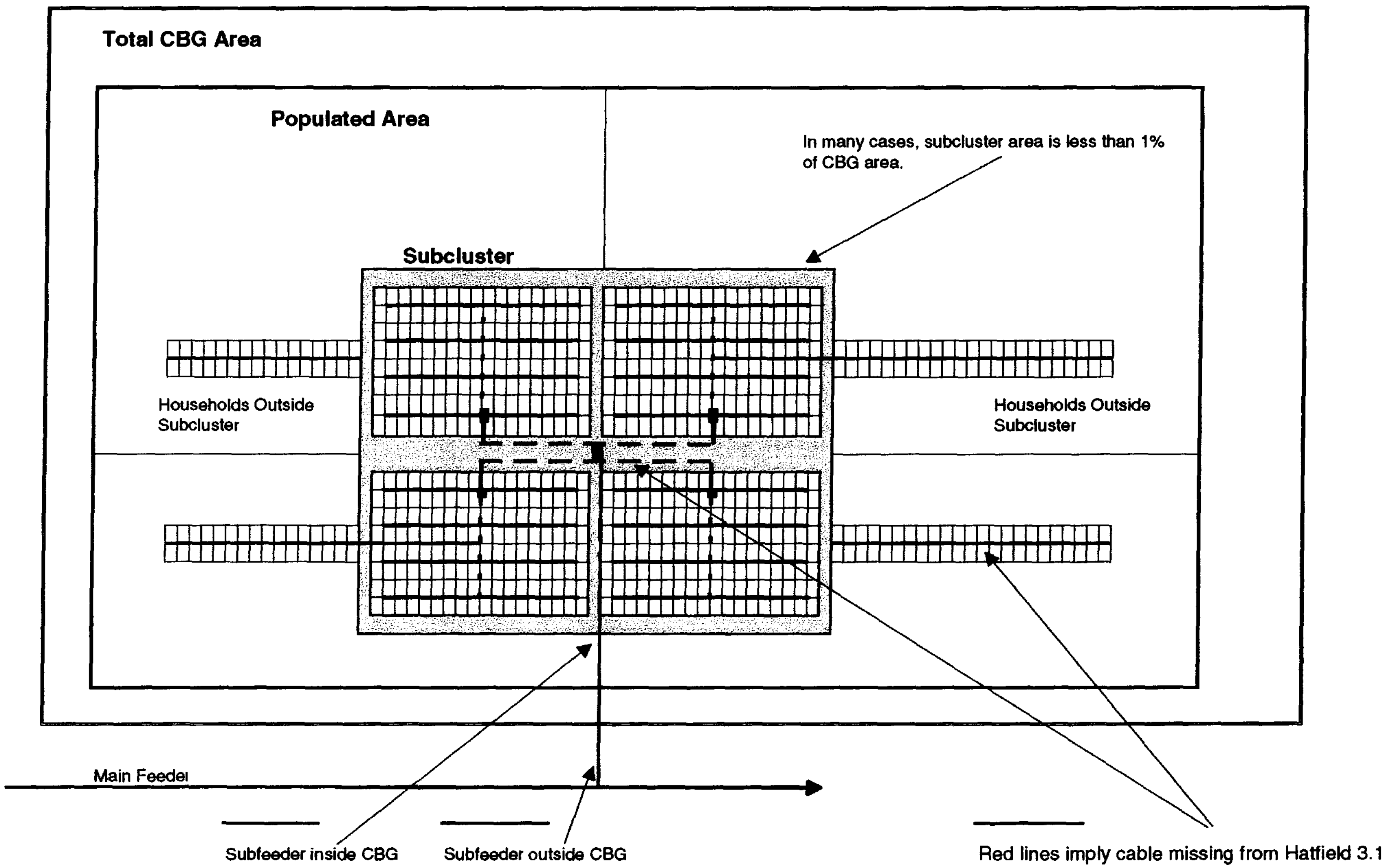
The ***riser cable investment*** is calculated, but not included (see feeder module).

The ***maximum size road cable investment*** is only computed for two feet of cable. The distance component of the equation is missing in the calculation (see column AH).

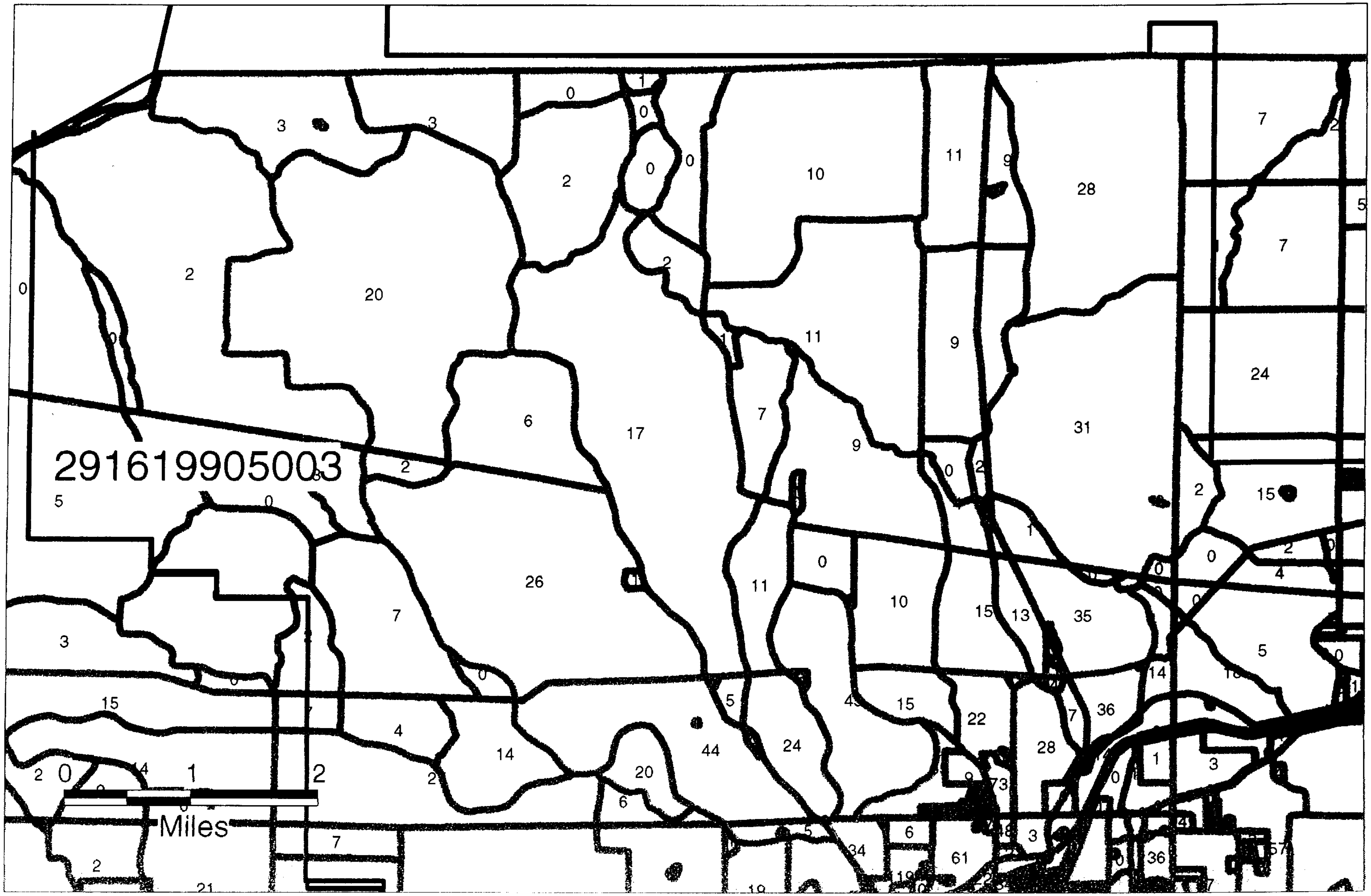
If the main feeder extends to the boundary of the CBG, the ***subfeeder*** needed inside the CBG is incorrectly omitted. See the output worksheet, column G.

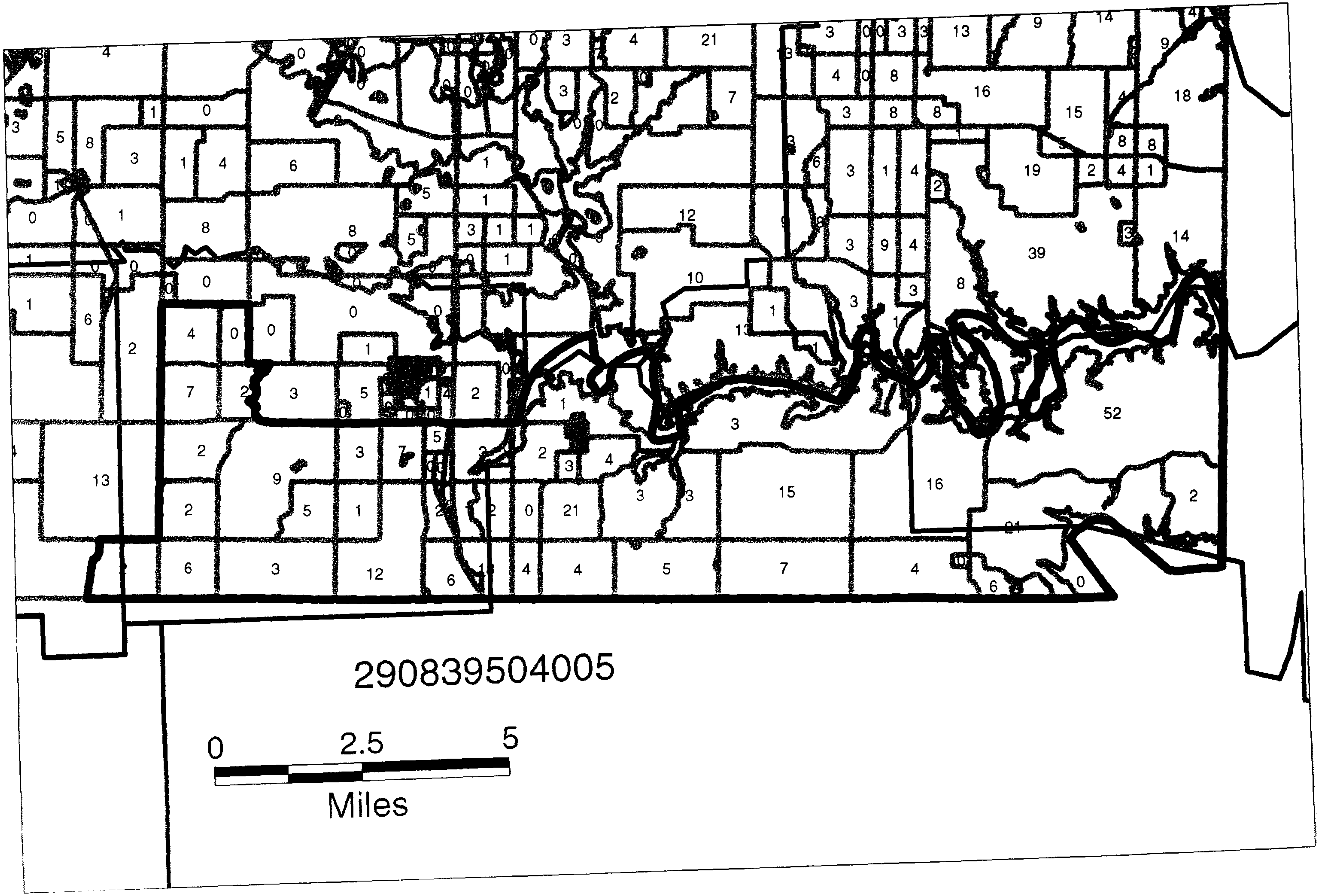
The ***main road cable distance***, as calculated, will only reach ¼ of households outside the town area. Column AE will reach only ½ the households and businesses that are outside the "town" area in a cluster. Since column AH subsequently uses 2 x the value in column AE for the total CBG, all cable, poles, conduit, and placement costs for the "out of town" area are understated by a factor of 1/quantity of clusters. [see diagram]

Clearly, the resultant network will not work. With so many problems discovered in a review of one-half of one module, there has to be concern about the continued viability of the model.



If subfeeder outside CBG = 0, entire subfeeder (inside and outside of CBG) is zero (0).


291619905003
0 1 2
Miles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